



Supplement of

A flux tower dataset tailored for land model evaluation

Anna M. Ukkola et al.

Correspondence to: Anna M. Ukkola (a.ukkola@unsw.edu.au)

The copyright of individual parts of the supplement might differ from the article licence.

Supplementary Information

The Supplementary Information contains:

Supplementary section 1
Tables S1-3

S1 Commands for FluxnetLSM

The raw data were processed into NetCDF files using the following commands, separately for each parent dataset. See Ukkola et al. (2017) and the package code (<https://github.com/aukkola/FluxnetLSM>) for details. The full processing code for all sites is provided at https://github.com/aukkola/PLUMBER2/blob/master/Step1_Process_all_available_flux_sites_for_PLUMBER2.R

FLUXNET2015 command:

```
convert_fluxnet_to_netcdf(site_code, infile, era_file, out_path,
                          datasetversion,
                          met_gapfill="ERAinterim",
                          flux_gapfill="statistical",
                          missing_met=100,
                          missing_flux=100,
                          gapfill_met_tier1=100,
                          gapfill_met_tier2=100,
                          gapfill_flux=100,
                          min_yrs=1,
                          check_range_action="warn",
                          include_all_eval=TRUE)
```

OzFlux commands:

Pre-processing:
preprocess_OzFlux(infile, outpath)

Processing:
convert_fluxnet_to_netcdf(site_code, infile, out_path,
 datasetname="OzFlux",
 met_gapfill="statistical",
 flux_gapfill="statistical",
 missing_met=100,
 missing_flux=100,
 gapfill_met_tier1=100,
 gapfill_met_tier2=100,
 gapfill_flux=100,
 min_yrs=1,
 check_range_action="warn")

La Thuile command:

```
convert_fluxnet_to_netcdf(site_code, infile, out_path,
                          datasetname="LaThuile",
                          met_gapfill="statistical",
                          flux_gapfill="statistical",
                          missing_met=100,
                          missing_flux=100,
                          gapfill_met_tier1=100,
                          gapfill_met_tier2=100,
                          gapfill_flux=100,
                          min_yrs=1,
                          check_range_action="warn",
                          copyfill=365,
                          regfill=365)
```

Table S1: Adjustments to time periods at selected sites based on meteorological data visual screening. Time period shows the final time period included in the final dataset and data release the parent dataset. Default LAI indicates the preferred LAI product chosen for the site. Priority variables refer to SW_{down} , Precip), T_{air} , Q_{air}) and Wind (see section 2.2.2).

Site	Time period adjustments	Time period	Data release	Default LAI
AR-SLu	Drop first and last year (priority variables heavily gap-filled)	2010	FLUXNET2015	MODIS
AT-Neu	-	2002-2012	FLUXNET2015	Copernicus
AU-ASM	-	2011-2017	OzFlux	Copernicus
AU-Cow	Drop first and last 2 years (missing Precip)	2010-2015	OzFlux	Copernicus
AU-Cpr	-	2011-2017	OzFlux	MODIS
AU-Ctr	-	2010-2017	OzFlux	MODIS
AU-Cum	-	2013-2018	OzFlux	MODIS
AU-DaP	Drop first year (Precip gap-filled)	2011-2017	OzFlux	Copernicus
AU-DaS	Drop first 2 years (Precip gap-filled)	2010-2017	OzFlux	MODIS
AU-Dry	Drop first 2 years and last 2 years (priority variables heavily gap-filled)	2011-2015	OzFlux	Copernicus
AU-Emr	-	2012-2013	OzFlux	Copernicus
AU-Gin	-	2012-2017	OzFlux	MODIS
AU-GWW	-	2013-2017	OzFlux	MODIS
AU-How	-	2003-2017	OzFlux	MODIS
AU-Lit	-	2016-2017	OzFlux	Copernicus
AU-Otw	Drop first year (missing SW_{down})	2009-2010	OzFlux	Copernicus
AU-Rig	-	2011-2016	OzFlux	MODIS
AU-Rob	-	2014-2017	OzFlux	Copernicus
AU-Sam	-	2011-2017	OzFlux	Copernicus
AU-Stp	Drop first year (priority variables heavily gap-filled)	2010-2017	OzFlux	Copernicus
AU-TTE	-	2013-2017	OzFlux	MODIS
AU-Tum	-	2002-2017	OzFlux	Copernicus
AU-Whr	Drop first 3 years (Precip missing)	2015-2016	OzFlux	MODIS
AU-Wrr	Drop first 2 years (priority variables heavily gap-filled especially during 2 nd year)	2016-2017	OzFlux	MODIS
AU-Ync	-	2011-2017	OzFlux	Copernicus
BE-Bra	Drop first 8 years (priority variables heavily gap-filled in 1 st and 8 th year)	2004-2014	FLUXNET2015	MODIS
BE-Lon	Drop first year (priority variables have too much gap-filling, SW_{down} especially odd)	2005-2014	FLUXNET2015	Copernicus
BE-Vie	Drop first year (priority variables heavily gap-filled)	1997-2014	FLUXNET2015	Copernicus
BR-Sa3	Drop first year and last year (priority variables heavily gap-filled)	2001-2003	FLUXNET2015	MODIS
BW-Ma1	Drop first year and last year (priority variables heavily gap-filled)	2000	LaThuile	MODIS
CA-NS1	Drop first 2 and last 2 years (priority variables heavily gap-filled)	2003	FLUXNET2015	MODIS
CA-NS2	Drop first year, Drop last year (priority variables heavily gap-filled).	2002-2004	FLUXNET2015	Copernicus
CA-NS4	Drop first and last year (priority variables heavily gap-filled)	2003-2004	FLUXNET2015	MODIS

CA-NS5	Drop first 2 years and last year (priority variables heavily gap-filled)	2003-2004	FLUXNET2015	MODIS
CA-NS6	Drop first and last year (priority variables heavily gap-filled)	2002-2004	FLUXNET2015	MODIS
CA-NS7	Drop first and last year (priority variables heavily gap-filled)	2003-2004	FLUXNET2015	MODIS
CA-Qcu	Drop first year (priority variables heavily gap-filled)	2002-2006	LaThuile	Copernicus
CA-Qfo	Drop first year (priority variables heavily gap-filled)	2004-2010	FLUXNET2015	Copernicus
CA-SF1	Drop first year (priority variables heavily gap-filled)	2004-2006	FLUXNET2015	MODIS
CA-SF2	Drop first 2 years (priority variables heavily gap-filled)	2003-2005	FLUXNET2015	MODIS
CA-SF3	Drop first 2 years and last year (priority variables heavily gap-filled)	2003-2005	FLUXNET2015	Copernicus
CH-Cha	Drop first year (priority variables heavily gap-filled)	2006-2014	FLUXNET2015	Copernicus
CH-Dav	-	1997-2014	FLUXNET2015	Copernicus
CH-Fru	Drop first 2 years (priority variables heavily gap-filled)	2007-2014	FLUXNET2015	MODIS
CH-Oe1	-	2002-2008	FLUXNET2015	MODIS
CN-Cha	-	2003-2005	FLUXNET2015	MODIS
CN-Cng	Drop first year and last year (priority variables heavily gap-filled)	2008-2009	FLUXNET2015	MODIS
CN-Dan	-	2004-2005	FLUXNET2015	MODIS
CN-Din	-	2003-2005	FLUXNET2015	Copernicus
CN-Du2	Drop first year (priority variables heavily gap-filled)	2007-2008	FLUXNET2015	MODIS
CN-HaM	Drop last year (T_{air} and Q_{air} heavily gap-filled)	2002-2003	FLUXNET2015	MODIS
CN-Qia	-	2003-2005	FLUXNET2015	MODIS
CZ-wet	Drop first year (Precip too heavily gap-filled)	2007-2014	FLUXNET2015	MODIS
DE-Bay	Drop first year (priority variables heavily gap-filled)	1997-1999	LaThuile	Copernicus
DE-Geb	-	2001-2014	FLUXNET2015	Copernicus
DE-Gri	-	2004-2014	FLUXNET2015	Copernicus
DE-Hai	-	2000-2012	FLUXNET2015	Copernicus
DE-Kli	Drop first year (priority variables heavily gap-filled)	2005-2014	FLUXNET2015	Copernicus
DE-Meh	Drop first year (priority variables heavily gap-filled)	2004-2006	LaThuile	MODIS
DE-Obe	-	2008-2014	FLUXNET2015	Copernicus
DE-Seh	Drop first year (priority variables heavily gap-filled)	2008-2010	FLUXNET2015	Copernicus
DE-SfN	Drop first year (priority variables heavily gap-filled)	2013-2014	FLUXNET2015	Copernicus
DE-Tha	Drop first 2years (Precip too heavily gap-filled)	1998-2014	FLUXNET2015	Copernicus
DE-Wet	-	2002-2006	LaThuile	MODIS
DK-Fou	-	2005	FLUXNET2015	MODIS
DK-Lva	-	2005-2006	LaThuile	Copernicus
DK-Ris	-	2004-2005	LaThuile	MODIS
DK-Sor	Drop first year (priority variables heavily gap-filled)	1997-2014	FLUXNET2015	Copernicus
DK-ZaH	Drop last year (Precip too heavily gap-filled)	2000-2013	FLUXNET2015	MODIS
ES-ES1	-	1999-2006	LaThuile	MODIS

ES-ES2	Drop first year (priority variables heavily gap-filled)	2005-2006	LaThuile	MODIS
ES-LgS	Drop last 2 years (priority variables heavily gap-filled)	2007	FLUXNET2015	MODIS
ES-LMa	-	2004-2006	LaThuile	MODIS
ES-VDA	Drop last 2 years (priority variables heavily gap-filled)	2004	LaThuile	MODIS
FI-Hyy	-	1996-2014	FLUXNET2015	Copernicus
FI-Kaa	Take first 3 years only (Precip heavily gap-filled and has unrealistic step change)	2000-2002	LaThuile	MODIS
FI-Lom	-	2007-2009	FLUXNET2015	MODIS
FI-Sod	Drop first 7 years (Precip gap-filled)	2008-2014	FLUXNET2015	Copernicus
FR-Fon	Drop last year (Precip heavily gap-filled)	2005-2013	FLUXNET2015	MODIS
FR-Gri	Drop first year (priority variables heavily gap-filled)	2005-2013	FLUXNET2015	Copernicus
FR-Hes	-	1997-2006	LaThuile	Copernicus
FR-LBr	Take the last 6 years (Precip heavily gap-filled)	2003-2008	FLUXNET2015	MODIS
FR-Lq1	-	2004-2006	LaThuile	MODIS
FR-Lq2	-	2004-2006	LaThuile	MODIS
FR-Pue	-	2000-2014	FLUXNET2015	MODIS
GF-Guy	-	2004-2014	FLUXNET2015	Copernicus
HU-Bug	Drop first year (priority variables heavily gap-filled)	2003-2006	LaThuile	MODIS
ID-Pag	-	2002-2003	LaThuile	Copernicus
IE-Ca1	-	2004-2006	LaThuile	Copernicus
IE-Dri	-	2003-2005	LaThuile	Copernicus
IT-Amp	Drop first year (priority variables heavily gap-filled)	2003-2006	LaThuile	MODIS
IT-BCi	Drop first year and last 4 years (v variables heavily gap-filled)	2005-2010	FLUXNET2015	Copernicus
IT-CA1	Drop first and last year (priority variables heavily gap-filled)	2012-2013	FLUXNET2015	MODIS
IT-CA2	Drop first year and last year (priority variables heavily gap-filled)	2012-2013	FLUXNET2015	MODIS
IT-CA3	Drop first year and last year (priority variables heavily gap-filled)	2012-2013	FLUXNET2015	MODIS
IT-Col	Keep last 8 years (priority variables heavily gap-filled, particularly Precip)	2007-2014	FLUXNET2015	MODIS
IT-Cpz	Drop first 4 years and last year (priority variables heavily gap-filled)	2001-2008	FLUXNET2015	MODIS
IT-Isp	-	2013-2014	FLUXNET2015	MODIS
IT-Lav	Drop first 2 years (Precip heavily gap-filled)	2005-2014	FLUXNET2015	MODIS
IT-LMa	Drop last 2 years (T _{air} and Wind heavily gap-filled)	2003-2004	LaThuile	MODIS
IT-Mal	Keep first year only (priority variables heavily gap-filled)	2003	LaThuile	MODIS
IT-MBo	Drop last year (Precip heavily gap-filled)	2003-2012	FLUXNET2015	MODIS
IT-Noe	-	2004-2014	FLUXNET2015	MODIS
IT-Non	Drop first year and last 4 years (priority variables heavily gap-filled)	2002	LaThuile	MODIS
IT-PT1	Drop first year (priority variables heavily gap-filled)	2003-2004	FLUXNET2015	Copernicus
IT-Ren	Take last 4 years only (v variables heavily gap-filled, particularly Precip)	2010-2013	FLUXNET2015	MODIS
IT-Ro1	Drop first 2 and last 2 years (priority variables heavily gap-filled)	2002-2006	FLUXNET2015	MODIS

IT-Ro2	Drop last 4 years (priority variables heavily gap-filled)	2002-2008	FLUXNET2015	MODIS
IT-SR2	-	2013-2014	FLUXNET2015	MODIS
IT-SRo	Drop first 4 years (Precip and Q _{air} heavily gap-filled)	2003-2012	FLUXNET2015	MODIS
JP-SMF	Drop first year (priority variables heavily gap-filled)	2003-2006	FLUXNET2015	MODIS
NL-Ca1	-	2003-2006	LaThuile	MODIS
NL-Hor	Drop first 4 years (priority variables heavily gap-filled)	2008-2011	FLUXNET2015	MODIS
NL-Loo	Drop first year (priority variables heavily gap-filled)	1997-2013	FLUXNET2015	Copernicus
PL-wet	-	2004-2005	LaThuile	MODIS
PT-Esp	Drop last 2 years (priority variables heavily gap-filled)	2002-2004	LaThuile	MODIS
PT-Mi1	Take last year only (missing Wind)	2005	LaThuile	MODIS
PT-Mi2	Drop first year (priority variables heavily gap-filled)	2005-2006	LaThuile	MODIS
RU-Che	Drop first and last year (priority variables heavily gap-filled)	2003-2004	FLUXNET2015	MODIS
RU-Fyo	Drop first 5 years (Precip heavily gap-filled)	2003-2014	FLUXNET2015	MODIS
RU-Zot	Drop first and last year (priority variables heavily gap-filled)	2003	LaThuile	Copernicus
SD-Dem	-	2005-2009	FLUXNET2015	MODIS
SE-Deg	Drop first year (priority variables heavily gap-filled)	2002-2005	LaThuile	Copernicus
UK-Gri	Drop first 3 years and last 5 years (priority variables heavily gap-filled)	2000-2001	LaThuile	MODIS
UK-Ham	Drop last year (priority variables heavily gap-filled)	2004	LaThuile	MODIS
UK-PL3	-	2005-2006	LaThuile	MODIS
US-AR1	Drop first year (priority variables heavily gap-filled)	2010-2012	FLUXNET2015	Copernicus
US-AR2	Drop first and last year (priority variables heavily gap-filled)	2010-2011	FLUXNET2015	Copernicus
US-ARM	-	2003-2012	FLUXNET2015	Copernicus
US-Aud	Drop first and last year (priority variables heavily gap-filled)	2003-2005	LaThuile	MODIS
US-Bar	Drop first year (Precip heavily gap-filled)	2005	LaThuile	MODIS
US-Bkg	Drop first year (priority variables heavily gap-filled)	2005-2006	LaThuile	MODIS
US-Blo	Drop first 3 years and last year (priority variables heavily gap-filled)	2000-2006	FLUXNET2015	Copernicus
US-Bo1	Drop first and last year (priority variables heavily gap-filled)	1997-2006	LaThuile	MODIS
US-Cop	Drop first and last 4 years (priority variables heavily gap-filled)	2002-2003	FLUXNET2015	Copernicus
US-FPe	-	2000-2006	LaThuile	MODIS
US-GLE	Drop first 5 years (priority variables heavily gap-filled, particularly Precip)	2009-2014	FLUXNET2015	Copernicus
US-Goo	Drop first 2 years (priority variables heavily gap-filled)	2004-2006	LaThuile	MODIS
US-Ha1	Drop first year (priority variables heavily gap-filled)	1992-2012	FLUXNET2015	MODIS
US-Ho1	-	1996-2004	LaThuile	MODIS
US-KS2	-	2003-2006	FLUXNET2015	MODIS
US-Los	Drop last 6 years (priority variables heavily gap-filled)	2000-2008	FLUXNET2015	MODIS
US-Me2	-	2002-2014	FLUXNET2015	Copernicus

US-Me4	-	1996-2000	LaThuile	MODIS
US-Me6	Drop first year (priority variables heavily gap-filled)	2011-2014	FLUXNET2015	MODIS
US-MMS	-	1999-2014	FLUXNET2015	MODIS
US-MOz	Drop first year (priority variables heavily gap-filled)	2005-2006	LaThuile	MODIS
US-Myb	Drop first year (priority variables heavily gap-filled)	2011-2014	FLUXNET2015	MODIS
US-Ne1	Drop first and last year (priority variables heavily gap-filled)	2002-2012	FLUXNET2015	MODIS
US-Ne2	Drop first year and last year (priority variables heavily gap-filled)	2002-2012	FLUXNET2015	MODIS
US-Ne3	Drop first and last year (priority variables heavily gap-filled)	2002-2012	FLUXNET2015	MODIS
US-NR1	Drop first year (priority variables heavily gap-filled)	1999-2014	FLUXNET2015	MODIS
US-PFa	-	1995-2014	FLUXNET2015	MODIS
US-Prr	Drop first year (priority variables heavily gap-filled)	2011-2013	FLUXNET2015	MODIS
US-SP1	Drop first 5 years (priority variables heavily gap-filled)	2005	LaThuile	Copernicus
US-SP2	Drop first 2 years priority variables heavily gap-filled)	2000-2004	LaThuile	Copernicus
US-SP3	-	1999-2004	LaThuile	Copernicus
US-SRG	Drop first year (priority variables heavily gap-filled)	2009-2014	FLUXNET2015	MODIS
US-SRM	-	2004-2014	FLUXNET2015	MODIS
US-Syv	Drop first year and last 6 years (priority variables heavily gap-filled)	2002-2008	FLUXNET2015	MODIS
US-Ton	-	2001-2014	FLUXNET2015	MODIS
US-Tw4	Drop first year (priority variables heavily gap-filled)	2014	FLUXNET2015	Copernicus
US-Twt	Drop first year	2010-2014	FLUXNET2015	Copernicus
US-UMB	-	2000-2014	FLUXNET2015	MODIS
US-Var	Drop first year (priority variables heavily gap-filled)	2001-2014	FLUXNET2015	MODIS
US-WCr	Drop last 8 years (priority variables heavily gap-filled)	1999-2006	FLUXNET2015	Copernicus
US-Whs	Drop first year (priority variables heavily gap-filled)	2008-2014	FLUXNET2015	MODIS
US-Wkg	Drop first year (priority variables heavily gap-filled)	2005-2014	FLUXNET2015	MODIS
ZA-Kru	Drop last 8 years (priority variables heavily gap-filled, particularly SW _{down})	2000-2002	FLUXNET2015	MODIS
ZM-Mon	Drop first 7 and last year (priority variables heavily gap-filled)	2008	FLUXNET2015	MODIS

Table S2: Excluded sites. The reason for excluding the site is provided. Data release indicates the parent dataset.

Site	Reason for excluding	Data release
AR-Vir	SW _{down} and Precip are mostly gap-filled	FLUXNET2015
AU-Ade	All Precip is gap-filled	OzFlux
AU-Fog	All Precip is gap-filled	OzFlux
AU-Lox	Not enough observed data	FLUXNET2015
AU-RDF	Not enough observed data	OzFlux
AU-Rgf	Not enough non-gap-filled data	OzFlux
AU-Wac	All Precip is gap-filled	OzFlux
AU-Wom	All Precip is gap-filled	OzFlux
CA-Man	All Q _{air} is gap-filled	FLUXNET2015
CA-Mer	Too much Precip gap-filled	LaThuile
CA-NS3	Precip looks unrealistic	FLUXNET2015
CH-Lae	All Precip is gap-filled	FLUXNET2015
CH-Oe2	No concurrent periods with observed Q _{air} and Precip	FLUXNET2015
CZ-BK1	Not enough observed data	FLUXNET2015
DE-Akm	All Precip missing	FLUXNET2015
DE-Lkb	Too much Wind gap-filled	FLUXNET2015
DE-RuR	All Q _{air} gap-filled	FLUXNET2015
DE-RuS	All Q _{air} gap-filled	FLUXNET2015
DE-Spw	All Precip gap-filled	FLUXNET2015
DK-NuF	Too much Wind gap-filled	FLUXNET2015
DK-ZaF	Too much T _{air} gap-filled	FLUXNET2015
ES-Ln2	All Precip gap-filled	FLUXNET2015
FI-Jok	All Precip gap-filled	FLUXNET2015
HU-Mat	Too much Precip gap-filled	LaThuile
IL-Yat	Too much Precip and SW _{down} gap-filled	LaThuile
IS-Gun	Not enough observed data	LaThuile
IT-Cp2	All Precip gap-filled	FLUXNET2015
IT-Lec	Wind missing	LaThuile
IT-Pia	Wind missing	LaThuile
IT-Tor	Too much Precip gap-filled	FLUXNET2015
JP-MBF	All Precip gap-filled	FLUXNET2015
NL-Lan	Not enough observed data	LaThuile
NL-Mol	Not enough observed data	LaThuile
NO-Blv	All Precip gap-filled	FLUXNET2015
RU-Ha1	Not enough observed data	FLUXNET2015
RU-Ha2	Precip missing	LaThuile
RU-Ha3	Precip missing	LaThuile
SE-Faj	Not enough observed data	LaThuile
SE-Fla	Too much Precip gap-filled	LaThuile
SE-Nor	Too much Precip gap-filled	LaThuile
SE-Sk2	Precip missing	LaThuile

SN-Dhr	All Precip gap-filled	FLUXNET2015
UK-EBu	All Wind gap-filled	LaThuile
UK-ESa	Too much Precip gap-filled	LaThuile
US-ARb	Not enough observed data	FLUXNET2015
US-ARc	Not enough observed data	FLUXNET2015
US-GBT	All Precip gap-filled	FLUXNET2015
US-ORv	All Precip gap-filled. Wetland site so cannot retrieve MODIS LAI	FLUXNET2015
US-Tw1	All Precip gap-filled	FLUXNET2015
US-Tw2	All Precip gap-filled	FLUXNET2015
US-UMd	All Precip gap-filled	FLUXNET2015
US-Wi0	Not enough observed data	FLUXNET2015
US-Wi5	Not enough observed data	LaThuile

Table S3: Additional corrections to site meteorological data. RH stands for relative humidity and VPD for vapour pressure deficit.

Site	Issue	Correction
All sites*	Some CO ₂ _{air} values missing	Gap-filled with values predicted from linear regression of available CO ₂ _{air} values against time
All sites*	Missing RH values	Gap-filled with RH values converted from VPD
All sites*	Missing LW _{down} values	Gap-filled with LW _{down} synthesised from T _{air} and RH
All sites*	Negative LAI, Precip, Wind, RH, Q _{air} , SW _{down} and LW _{down}	Negative values set to at zero
AU-Cow	Bad RH values	Replaced with RH values converted from Q _{air} , T _{air}
AU-Tum	Three consecutive anomalous P _{surf} values > 84000 Pa	Replaced P _{surf} values with the previous time step's value
BE-Lon	Unrealistic LW _{down} seasonal cycle during 2008	Replaced values with LW _{down} synthesised from T _{air} and RH
BE-Vie	Large step change in CO ₂ _{air}	Replaced values prior to step change with values predicted from linear regression of CO ₂ _{air} against time (constructed using data after step change)
ES-ES2	One day missing in T _{air} , VPD, Q _{air} , Precip, SW _{down} , Wind, P _{surf} and CO ₂ _{air}	Gap-filled by repeating the previous day's values for each variable
DK-Sor	Large spikes in CO ₂ _{air}	Replaced CO ₂ _{air} time series with values predicted from linear regression of CO ₂ _{air} against time (constructed using all values)
PT-Mi2	Anomalously high LW _{down} values	Replaced anomalous values by linearly interpolating between previous and next non-anomalous value
RU-Fyo	LW _{down} heavily gap-filled between 2006-2013 with an unrealistic seasonal cycle	Replaced this period with LW _{down} values synthesised from T _{air} and RH

RU-Zot	Missing values in LW _{down} and RH	LW _{down} gap-filled by synthesising it from T _{air} and RH. RH gap-filled by converting it from VPD
US-ARM	LW _{down} heavily gap-filled between 2004-2006 with an unrealistic seasonal cycle	Replace this period with LW _{down} values synthesised from T _{air} and RH
US-NR1	LW _{down} heavily gap-filled between 2004-2005 with an unrealistic seasonal cycle	Replace this period with LW _{down} values synthesised from T _{air} and RH
AR-SLu, AT-Neu, AU-Sam, CA-Qcu, CN-Cha, CN-Dan, CN-Din, CN-Qia, RU-Zot, SD-Dem, US-Aud, US-Bkg, US-Bo1, US-FPe, US-Goo, US-SP1, US-SP2, US-SP3	Entire CO _{2,air} time series or large proportions of it were missing, or the time series had large step changes	Replaced CO _{2,air} data with annual Mauna Loa atmospheric CO ₂ time series (repeating each year's value at the site temporal resolution, i.e. 30 or 60 minutes).

*where applicable